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A BIOLOGICAL EVALUATION OF THE INCIDENCE AND INTENSITY OF ANNOSUS ROOT ROT IN THE RED LAKE MOUNTAIN WHITE FIR THINNING AREA

By

J. W. Byler, J. R. Parmeter, Jr., and R. S. Smith

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A Biological Evaluation of the Incidence and Intensity of Annosus Root Rot in the Red Lake Mountain White Fir Thinning Area

The Silvicultural Development Unit (SDU) of Region 5, Forest Service, is establishing field test plots in which to study silvicultural methods of thinning for use in true fir stands. At the request of the SDU, Jim Byler examined five of these test blocks for disease. The blocks were examined on July 8 and 10.

The examination indicated that annosus root rot (Fomes annosus) was present in the test blocks, but it appeared to be at a low level. Few dead trees were present, but some of those present had annosus-type rot. F. annosus fruiting bodies were found on a subsequent examination by Jim Byler, Dick Parmeter (University of California, Berkeley), Mike Srago and Ed Wood.

The extent to which living trees in the stand were infected and/or damaged by root rot could not be determined from above-ground observations. Past research results indicated that the tap roots and laterals in firs growing in and around F. annosus mortality centers in previously entered old growth stands are often extensively decayed predisposing the host to insect attack and windthrow (Ferrell and Smith, 1976; Parmeter, personal communication). Information on the incidence of root rot is not available on trees in uncut young sawtimber stands exhibiting few or no infection centers.

One objective of the Red Lake thinning tests is to determine, through a series of planned remeasurements, the optimum reserve basal area for white fir. Results of these tests will be applied in white fir stands throughout California. Since F. annosus-caused mortality and growth loss affects stand growth and yield, and since the intensity of infection resulting from thinning of young stands is unknown, an evaluation was made of the current extent and intensity of infection and root decay in these lightly-affected stands at the time of cutting (see Project Plan). A similar post-treatment evaluation will be made in approximately five years to determine the degree of root decay development, mortality, Scolytus ventralis attacks, and growth loss associated the various levels of thinning.

The root rot study was a cooperative project between the Region (FIDM and SDU), U.C. Berkeley (J.R. Parmeter, Jr,) and the PSW Station (G.T. Ferrell). Most of the following preliminary technical information was summarized by Parmeter.

TECHNICAL INFORMATION

The test blocks include about 60 acres of nearly pure, young sawtimber-sized white fir stands. The present volume/acre is about 500 M.

1. Root examination

Ninety-five trees were pulled out of the ground by a winch and notes were taken on the amount of root decay and infection in the exposed

root systems. Damage noted was: no root infection (45 trees), death of 1-5 rootlets (33 trees), death of 6 or more rootlets (6 trees), death of one or more large lateral roots (8 trees, of which 2 were pines), decay of the taproot (3 trees). In general, the amount of root damage was much less than expected. Numbers of trees showing root damage on the 6 plots ranged from 22% to 89%, with a somewhat higher (63, 89, 33%) but doubtfully significant amount of damage in 3 plots of the south area than in the 3 northern plots (22, 30, 63%).

Of the damage that was observed, most was dieback of small rootlets (2-15 mm diameter). Only a few trees showed decay of major roots or taproots, and this decay was generally the A. mellea type. The F. annosus type of decay found associated with fir roots in other areas was absent.

2. Root isolations

Isolations were made from 96 roots of 32 trees. Because most were dead root tips well colonized by molds, readings were difficult to obtain. Roots of 3 trees yielded F. annosus. A. mellea was isolated from or tentatively identified from the isolation plates of 15 trees. The roots of the remaining trees gave miscellaneous molds and stain fungi.

All dead root pieces were also incubated in polyethylene bags, but subsequent examination failed to show any conidial fruiting of F. annosus. In addition, students attempted isolations from a number of samples, but no further F. annosus or A. mellea was obtained.

3. Stump disc incubations

Discs were taken from 94 trees, generally near stump height, to determine age, growth rate, and amount of wetwood. Because roots showed so little evidence of F. annosus, discs were not deliberately incubated for F. annosus identification, but most discs were stored in polyethylene bags or under canvas. During the process of ring studies, conidia of F. annosus were observed on some discs, therefore all available discs were checked. Out of 64, twenty-seven showed conidia of F. annosus. Since these might represent latent infections or aerial contamination of discs, a second set of discs, one disc from each of 55 trees, was collected, using disinfected saws and rapid placement in bags to minimize the change of aerial contamination.

Out of the 55 discs, 32 developed conidia of F. annosus. Thirty-six of the 55 discs were from trees previously read for conidia. Ten trees were negative both times, 18 were positive both times, and 9 showed negative in one collection and positive in the other. These data suggest strongly that F. annosus was present in many trees without visible symptoms.

4. Discussion

Previous root exposure studies with fir (involving over 100 trees) in other areas and stands have indicated extensive decay of taproots and laterals in most trees. These studies have generally been made in and around mortality centers in stands showing a high incidence of F. annosus.

Roots of the Lassen trees showed a little taproot decay and the first assumption was that little or no F. annosus was present in the live trees. The high frequency of F. annosus in stump discs, however, indicates that the fungus is widespread in the yet unthinned stands.

It is still possible that most of the disc infection came in after the trees were pulled, perhaps by being drawn in the tracheids or entering through the bark along the stems. Neither seems likely. The alternative is that half or more of the trees have F. annosus in the wood of the butt without showing decay or symptoms. If so, the stands may be in an early stage of infection, with decay not yet developed, a condition similar to what we have seen in previous studies. In any case, there are several important questions that need answers.

RECOMMENDATIONS

This evaluation has raised more questions than answers, many of which are central to how we manage true fir. It is therefore recommended that similar evaluations be made in other true fir thinning test blocks which are started and that future post-treatment evaluations also be made. Research should be encouraged to study the epidemiology and etiology of this root disease in true fir. Tentative silvicultural recommendations are made, however, based on results of this evaluation.

1. Evaluations

Two very different conditions are now known to exist in white fir stands. The first is characterized by extensive decay in the root systems of living trees, and an elevated level of tree mortality usually involving S. ventralis. The decay is caused by F. annosus and A. mellea. The second condition is characterized by trees in which these two root rot fungi are present in the stems and roots but the trees have little or no decay. It is important to get baseline data on the extent of decay in true fir thinning areas that will be used to develop silvicultural methodology. It is also important to monitor the thinned areas for tree mortality, insect activity, growth and decay, and check dead trees for F. annosus and other pests. Thinning may affect the level of damage caused by the fungus.

2. Research

Little research information is available on the epidemiology and etiology of F. annosus on true fir. Research is needed to determine (1) how and when infection occurs in white fir stands, (2) how management affects incidence of F. annosus and secondary pests such as Scolytus ventralis, and (3) what factor(s) cause one stand to have "high" and another "low" mortality. The objective of these studies should be to determine how white fir stands can be managed to minimize damage from root disease and associated pests.

3. Silviculture

The evaluation was made in order to provide baseline information on the level of infection and root decay in the test plots rather than to give specific management recommendations. However, results suggest the following tentative conclusions.

a. It appears that the use of borax is not warranted in cuttings made in commercial true fir stands. If trees in uncut young stands are already infected, a preventative treatment at the time of cutting would be ineffective. A borax test is in progress in the Red Lake thinning plots to provide more information on the effectiveness of borax in white fir.

b. Cuttings made in young true fir stands should be made using logging systems that minimize the basal injury to leave trees. Since the fungus is already present in these stands, the likelihood of extensive decay following logging is high. A study of the extent of decay of true fir following logging wounds is planned for 1978.

REFERENCE

Ferrell, G.T. and R. S. Smith, Jr. 1976. Indicators of Fomes annosus Root Decay in Sapling White Fir. Forest Sci. 22:365-369.

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Smith

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

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REPLY TO: 5230 Evaluation January 31, 1977

SUBJECT: A Biological Evaluation of the Incidence and Intensity of Annosus Root Rot in the Red Lake Mountain White Fir Thinning Area

TO: Forest Supervisor, Lassen N.F.

Enclosed, find a report of a biological evaluation that was made on the Silvicultural Development Units' thinning plots at Red Lake Mountain. I would like to express my appreciation of the excellent cooperation that we received on this project from Gary Fiddler and his staff. Gary was responsible for pulling the trees, and assisted with other aspects of the project. Please thank him for us.

Wilfred L. Freeman Jr.

WILFRED L. FREEMAN, JR., Director
Forest Insect and Disease Management

Enclosure